8.0 INSPECTION OF GENERAL AREAS

The inspector should examine other areas around the dam and reservoir while performing routine inspections. An awareness of the complete dam environment will help the owner maintain the dam and be able to make improvements if conditions warrant. The following features and areas should be inspected during every routine dam inspection:

Figure 8-1 Shoreline areas and upstream watersheds should be visually inspected.

- Access
- Shoreline
- Reservoir area
- Submerged areas
- Watershed and tributary channels
- Mechanical and electrical systems
- Instrumentation
- Retaining structures
- Downstream hazards
- Downstream channel obstructions
- Upstream and downstream dams
- Bridge piers alignment and settlement
- Natural features, such as springs, sinkholes, rock outcrops

The inspector should examine all of these features and areas and record any changes or concerns in the inspection report. Photographs should be taken of problem conditions, and measurements of some problems may need to be made, such as slides on shoreline slopes, or cracks in access roads. Measurements and photographs will allow the inspector to monitor changes from one inspection to the next. Recent aerial photographs are very helpful in evaluating changing conditions in the upstream and downstream watersheds. The dam owner should be alerted to any conditions that may present a potential safety hazard. Deteriorated access roads, unauthorized activities (dirt bikes, 4-wheelers, etc), large landslides, upstream and downstream development, and severe sediment buildup are potentially hazardous concerns.

Figure 8-2 This dam has access to and over the embankment, however it may not be able to support heavy equipment.

Access to the dam, the reservoir, and the appurtenant works is important for a number of reasons, including dam maintenance, dam inspections, dam emergencies, and use of the dam and reservoir for its intended purpose. The inspector should visually check all adjacent roads and access roads to the dam and crest. He/she should note any deterioration and obstructions that may be present, and

record them in the inspection report. Photographs should be taken for damaged road sections, and corrective measures recommended.

Figure 8-3 This reservoir has severe shoreline erosion due to inadequate vegetation.

The shoreline and reservoir area should be checked for erosion, landslides, cracks, whirlpools, debris, burrowing animals, sediment buildup, and man-made changes and structures along the shore. Landslides into the reservoir can reduce the storage capacity which, in the worst case, may cause the dam to overtop during severe storm events. Signs of landslides include embankment cracking, scarps, and sloughs. Steep slopes along the shoreline are particularly vulnerable to slides. The inspector should also look for sign of seepage from slope areas. Whirlpools may indicate leaks or piping in the bottom of reservoir or along submerged outlets. Burrowing animals should be monitored because they may migrate to the embankment area where they may cause serious harm. Erosion along the shoreline will result in additional sediment entering the reservoir and filling up water space, as well as reducing the available reservoir area.

Figure 8-4 Excessive vegetation in reservoir almost completely conceals the spillway riser.

The reservoir submerged areas should be checked for sediment, debris, and excessive vegetative growth, including algae. Sediment from upstream areas is an ongoing problem in most reservoirs, and is very difficult, if not impossible to stop. When sediment deposits become severe, they should be removed; the usual method is dredging. Although sediment buildup is a concern because it diminishes the value and use of the reservoir, it normally does not affect the dam's stormwater storage capacity unless the sediment levels rise above the normal water level. Algae are not normally a safety concern, but they make the reservoir unsightly. Safe treatments for algae are available. Algae are often caused by excessive soil nutrients being carried into the reservoir by stormwater runoff, usually from farm fields and lawns.

If the dam or reservoir includes mechanical and electrical features, they should be inspected for disrepair and deterioration. This includes items previously discussed, including spillway gates, sluice gates or valves, stoplogs, flashboards, relief wells, and siphons. It also includes emergency power sources, guardrails along roads, signage,

buried cables and utilities, outfall pipes, conduits entering the reservoir, etc. All mechanical and electrical equipment should be operated at least once per year, and preferably more often. The tests should be conducted by the owner or operator, and should include the full operating range of the equipment under actual operating conditions. Each operating device should be permanently marked for easy identification, and all operating equipment should be kept accessible. All controls should be checked for proper security to prevent vandalism, and all operating instructions and manuals should be checked for clarity and maintained in a secure, but readily accessible location.

Figure 8-5 Downstream view of gates on a central-Indiana dam.

Figure 8-6 Badly deteriorated wall along spillway discharge channel.

The inspector should always check instrumentation that may be used to monitor dam performance or dam safety concerns. This includes items such as piezometers, inclinometers, tiltmeters, weirs, flumes, flow meters, etc. This equipment should be inspected to make sure it is in good condition and has not deteriorated or been damaged.

Retaining walls are often constructed along shorelines, discharge areas, and other dam areas to help stabilize steep slopes, or to support features such as roads, buildings, and parking lots. The retaining walls should be checked for potential stability concerns, such as structural cracking, horizontal displacement or tilting, settlement, erosion of the foundation area, and uncontrolled seepage. The failure of a retaining wall may create potential safety hazards, especially if they support parking areas and roads, or if the failure results in a large landslide into the reservoir.

The upstream watershed should be checked primarily for new development which can increase the amount of runoff that enters the reservoir. Impervious areas, such as parking lots, rooftops, and roads will dramatically increase the amount and rate of runoff. Construction sites that disturb large areas of soil will also result in increased runoff as well as increased sediment. New dams in the upstream watershed may also impact the dam that lies downstream. Dams and reservoirs will alter the runoff patterns

and the timing of the peak runoff rates. Urban development in the watershed can increase the size of flood peaks and the volume of runoff, thereby making a previously acceptable spillway inadequate. The dam hydrologic and hydraulic analyses may have to be updated if the upstream development is significant, or if a new dam is constructed upstream. Improvements to the dam appurtenant facilities, such as spillway size, outfall linings, and embankment top elevation may have to be implemented if the development creates a significant increase in inflow to the reservoir.

Figure 8-7 Downstream tailwater inundates toe of dam embankment.

Downstream development may create new safety hazards for the dam owner in the event that the dam would fail. New houses, roads, and other buildings that are occupied by people may change the hazard classification of the dam if these features are within the area which would be inundated if the dam failed. New features must be reported to the owner immediately upon their identification.

Downstream channel obstructions, including dams, can have an impact on the discharge from the dam if the new facilities are close enough. Tailwater that backs up from dams and other obstructions during floods, may reduce the discharge capacity of the upstream dam, especially if the upstream dam has a conduit spillway. The hydrologic and hydraulic calculations for the new features, if performed, should take the upstream dam into account. Tailwater from obstructions should be carefully evaluated to determine if it will impact the upstream dam discharge structures.

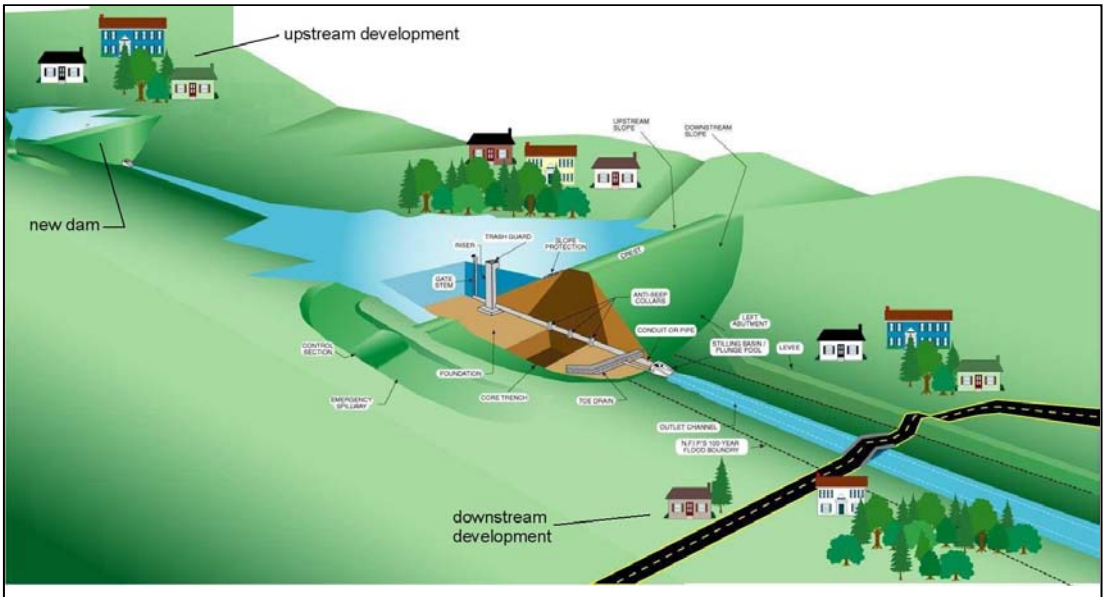

Figure 8-8 Sketch of upstream and downstream development features that can impact the operation of a dam.